REMARKS

Upon careful and complete consideration of the Office Action dated October 21, 2003, applicants have amended the claims which, when considered in conjunction with the comments herein below, are deemed to place the present application into condition for allowance. Favorable reconsideration of this application, as amended, is respectfully solicited.

Claims 7, 19-26, 31-35 and 37-38 were rejected by the Office Action under 35 U.S.C. §112, second paragraph, as allegedly "being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention."

Claim 7 was rejected as allegedly being indefinite with respect to defining the solution as a "xylose process stream or side stream". It is again respectfully submitted that these terms are terms of art fully clear, well-understood and recognized to the skilled artisan. The term "xylose process stream" refers to any process stream in a xylose manufacturing process, while the term "side stream" refers to a process stream not enriched with xylose. As such, this limits the method of the invention claimed in claim 1 to a xylose manufacturing process. It is respectfully submitted that claim 7 is not indefinite as alleged and the rejection of the claim is respectfully requested to be withdrawn.

Claims 19-26 were also rejected for the use of the terms "a fraction" or "the fraction". The term "fraction" as used in the present application refers to a part of the solution coming out or being eluted from a chromatographic column. The Examiner's attention is respectfully directed to page 8 of the subject specification, lines 20-21, where it is indicated that the "fractions of the outcoming solutions are collected at suitable intervals and analyzed." Based on this common definition, the terms "a fraction" or "the fraction" found in claims 19-26 have all been amended to read "fraction of the outcoming solution".

We believe said amendments obviate the rejection of these claims and it is consequently respectfully requested that said rejection be withdrawn.

Claims 31-33 have been rejected for insufficient antecedent basis with respect to the term "feed solution." The Examiner indicated that this rejection could be overcome by incorporating the term "feed solution" into claim 1. Applicants have done this. Additionally, applicants have also amended claims 2, 5, 7, 8, 10, 19, 21 and 43-45 in a similar manner for consistency purposes. Consequently, based on the amendments indicated above, it is respectfully requested that the rejection of claims 31-33 be withdrawn as well.

The Office Action next rejected claims 1, 12-14, 16, 27-31 and 42 under 35 U.S.C. §102(a) as allegedly being anticipated by U.S. Patent No. 5,998,607 to Heikkila et al. (hereinafter referred to as "Heikkila et al."). As presently claimed, the present invention is directed to a method comprising a multistep process for recovering one or more monosaccharides from a feed solution containing at least two monosaccharides selected from the group consisting of rhamnose, arabinose, xylose and mixtures thereof by using chromatographic separation comprising at least one step, where a weak acid cation exchange resin is used for the chromatographic separation. The recovery of one or more monosaccharides from the feed solution containing at least two monosaccharides as claimed is indicating the recovery of a fraction comprising a specific monosaccharide. It is not recovering a solution comprising multiple monosaccharides. The method of the present invention for recovering a fraction comprising a specific monosaccharide is made possible by the surprising discovery of the different elution order of components in a chromatographic column using a weak acid cation exchange resin.

Heikkila et al. is being cited for teaching a method of separating xylose from a Mg-sulphite cooking liquor. The Examiner, in alleging the disclosure of Heikkila et al. anticipates the claimed invention, stated that the "xylose is separated from the Mg-sulphite cooking liquor (which is known in the art to contain multiple monosaccharides, including

xylose, arabinose, and rhamnose) using a slightly acid cation exchange resin... This resin is known to be a weak acid cation exchange resin ..." Applicants respectfully disagree.

The Office Action is relying on Example 11 of Heikkila et al. Heikkila et al. disclose a method for separating xylose together with xylonic acid from a Mg-sulphite cooking liquor using a WAC resin (weak acid cation exchange resin). According to Example 11 of Heikkila et al., "[t]he salts, xylose and xylonic acid were eluted almost simultaneously (xylonic acid slightly later)." The WAC resin was not effective in separating these compounds from each other. That is, although the Examiner's allegation that xylose is being separated from the Mg-sulphite liquor may be true, it must be recognized what else is being separated along with the xylose in Example 11 of Heikkila et al. The separation and/or identification of other sugars such as rhamnose and arabinose have neither been disclosed nor suggested by Heikkila et al., or has the problems caused by other sugars (such as rhamnose and arabinose) been recognized by Heikkila et al. Thus, in accordance with the teachings of Heikkila et al., these sugars could even be in the same fraction as the xylose and xylonic acid. As is discussed in the present specification on page 2, line 22 to page 3, line 4, the problem with Heikkila et al. has been the insufficient separation of xylose and xylonic acid. There is no teaching or suggestion by Heikkila et al. that use of a weak acid cation exchange resin could solve this problem. The separation of the monsaccharides in Heikkila et al. have been found to be unsatisfactory as all the sugars elute at almost the similar retention time as xylose.

It is respectfully submitted that Heikkila et al. do not disclose, teach or suggest the use of a weak cation exchange resin for the recovery of monosaccharides from each other. That is, Heikkila et al. do not teach the recovery of rhamnose, arabinose and/or xylose from a solution containing at least two of them. Further, Heikkila et al. do not disclose the recovery of xylose from rhamnose and/or arabinose.

Accordingly, it is respectfully submitted that the claimed invention is not anticipated by the Heikkila et al. disclosure and it is respectfully requested that the rejection of the claims under 35 U.S.C. §102(a) be withdrawn.

Claims 1-6 and 8-49 were further rejected by the Office Action for allegedly being unpatentable over Heikkila et al. in combination with Blaschek et al., Journal of Chromatography, 256 (1983), pp. 157-163 (hereinafter referred to as "Blaschek et al."). In making this rejection, the Office Action is once again relying on Heikkila et al. as teaching a method of separating xylose by using a slightly acidic cation exchange resin. The Office Action then relies on the teachings of Blaschek et al. to motivate the skilled artisan to take the "xylose-containing" solution from Heikkila et al. and subject it to multiple chromatography runs in order to separate the various sugars. The Office Action in fact concluded: "thus Blaschek et al. do indeed recognize that one run on one column is not sufficient to separate various monosaccharides from each other." This clearly identifies the misunderstanding of the present invention by the Examiner. The present invention is separating various monosaccharides from each other in one run on one column.

Blaschek et al. disclose methods for analyzing sugars by high-performance liquid chromatography (HPLC) on an amino bonded phase (APS-Hypersil) using acetonitrile-water (75:25; v/v) as an eluent and on a cation-exchange resin (Aminex HPX-87P, strong acid cation exchange resin) using water as an eluent.

Monosaccharide mixtures, in Blaschek et al., containing L-rhamnose, L-arabinose, D-xylose, D-mannose, D-galactose and D-glucose were partially separated in a first run on an amino bonded phase into rhamnose and two incompletely separated fractions containing xylose-arabinose and mannose-glucose-galactose. These two semi-separated fractions were then subjected to a second run on a strongly acid cation-exchange resin to further separate the individual components from each other.

It is clearly evident, as noted above, that Blaschek et al. do not disclose or suggest the use of a weak acid cation exchange resin for the recovery of monosaccharide components like rhamnose, arabinose and/or xylose from a solution containing at least two of them. As was quoted above, the Examiner noted in the Office Action that one run is not sufficient to separate various monosaccharides from each other. This, in fact, teaches away from the present invention. The present invention is directed to a multistep process for recovering rhamnose, arabinose and/or xylose from a solution containing at least two of them by using chromatographic separation comprising at least one step where a WAC resin is used. The other step(s) of this multistep process may be crystallization, filtration, evaporation, precipitation and ion exchange in addition to chromatographic separation. It is again stressed that the method of the present invention is achieving the separation of the monosaccharides in the feed solution in a one step chromatographic separation using a weak acid cation exchange resin.

Several chromatographic methods (also multistep processes) for separating sugars were known in the art at the time the present invention was made. Strong acid cation exchange resins were most often used. A weak acid cation exchange resin, on the other hand, although known for use in ion exchange processes, was not earlier suggested for chromatographic separation of sugars.

It was found in connection with the present invention, however, that a weak acid cation exchange resin could advantageously be used in a method for the chromatographic separation of sugars. In addition, it was surprisingly found that the order of elution in a WAC-system differed from that of a strong acid cation exchange-system and the order of elution could be affected by changing the pH of the system. As disclosed in the present specification on page 5, lines 11-21, the order of elution seems to be affected by the hydrophilic/hydrophobic interaction between the monosaccharide and the resin. If the resin

is in hydrophilic form, the most hydrophobic monosaccharide elutes first and the most hydrophilic last.

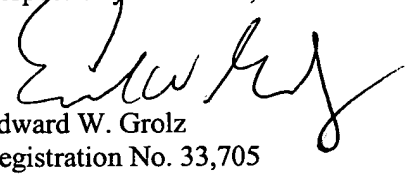
Again, Heikkila et al. show that xylose and xylonic acid are eluted simultaneously when a weak acid cation exchange resin is used and that the separation is neither different nor advantageous when compared with a strong acid cation exchange resin (the Examiner's attention is respectfully directed to Example 13 of Heikkila et al.).

Further, neither Heikkila et al. nor Blaschek et al. teach the effect of pH in a chromatographic separation using a weak cation exchange resin. And, contrary to the allegation made by the Office Action, it is respectfully submitted that one of ordinary skill in the art would not have expected that pH affects the eluation of neutral/uncharges compounds like sugars.

For the reasons given above, it is respectfully submitted that the present invention as claimed is not obvious in view of Heikkila et al. and Blaschek et al., alone or in combination, and the rejection of the claims based on these references is respectfully requested to be withdrawn.

Finally, it is further submitted that all the claims in the application as presently submitted contain patentable subject matter and a Notice of Allowance is earnestly solicited.

Respectfully submitted,



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